International Commemorative Symposium for the Incheon Bridge - IBS 2009
23. September, Songdo Convensia, Incheon, Korea

THE ROLE OF THE CONTRACTOR'S CHECKING ENGINEER

A J Yeoward, Project Director, Halcrow-Arup-Dasan JV

Summary

A 12.3 km long sea crossing is currently under construction at Incheon in South Korea. At a cost of US$1.4 billion, the crossing will link the new Incheon International Airport on Yeongjong island to Songdo (New City) and the new International Free Enterprise Zone (IFEZ) which are both currently under construction. A cable stayed bridge will cross the 625.5m wide by 74m high navigation channel leading to the Port of Incheon. With an 800m long main span, this will be the longest spanning bridge in South Korea and will form part of one of the longest sea crossings in the world. A joint venture team comprising Halcrow, Arup and local consultant Dasan was appointed by design and construct contractor Samsung Construction JV (SCJV) as the Contractor's Checking Engineer (CCE) in March 2005.

1. Introduction

The Incheon Bridge will carry six lanes of traffic across the straits between Yeongjong island and the Korean peninsula. The project is being procured by the Korea Expressway Corporation (KEC) on a BOT basis. KODA Development Ltd, the AMEC-led concessionaire, in joint venture with the City of Incheon, will finance and manage the toll-bridge for 30 years before returning the project to the Korean government.

Construction of the bridge was let on a Design & Build basis and construction works began in June 2005. SCJV, a group of seven Korean construction companies are carrying out the works with design services provided by consultants Seoyeong Engineering (Korea), Chodai (Japan) and others.

The majority of the length of the bridge is constructed as low level viaduct structures with pretensioned precast 50m long concrete box girder spans. Where the alignment rises to cross the navigation channel, precast segmental balanced cantilever approach bridges with 145m spans link the viaducts to the cable stayed bridge which provides the 800m long navigation span itself. Korea is in a region of moderate seismicity and the bridge is designed for a 1,000 year return period event which governs the design of the substructures. In addition the bridge can be subject to typhoon wind loading which is significant for the high level structures. In particular wind buffeting loads and aerodynamic stability has been important to the design of the cable stayed bridge.

2. The role of the Contractor's Checking Engineer

The CCE's role was to perform an independent design check of the permanent works and major temporary works as well as carrying out an independent review of all other temporary works and a number of technical reports by others.

Managing and organising the CCE's joint venture team required communicating and coordinating with the checking teams, which were located in different offices worldwide, as and when the design packages became available. Working closely with the design team in the Incheon site office was essential for the effective delivery of design packages to the checkers and dealing with the day to day issues arising during the procurement of the design.

Site offices were provided by SCJV and senior representatives from Halcrow, Arup and Dasan maintained a full time presence there during the design phase of the project. The contract duration for the CCE's checking role was initially 2 years but this was extended in March 2007 to keep a CCE presence on site further into the construction period.

3. Basis of design

The design basis for the Incheon Bridge was originally set out in two key documents, the Project Performance Requirements (PPR) written by the Ministry of Construction and Transportation and the Concessionaire's Supplementary Requirements (CSR) introduced by KODA. The PPR references the AASHTO LRFD Bridge Design Specifications as the key standard for structural design. However, in order to ensure a consistent performance with other Korean bridges the PPR also wrote out a full set of loads and load combinations which were extracted from the Korea Bridge Design Standards. The bridge had to be designed to cover both the LRFD and the PPR loading conditions although in both cases analysis, verification and detailing requirements were in accordance with LRFD. In almost all cases the PPR loads proved to be the governing design condition.

Before award of the contract, SCJV entered into negotiations with KODA and KHC concerning interpretation of the design basis. Issues involved clarification of the design basis, interpretation of ambiguous or conflicting requirements and requests for relaxation of certain requirements which were perceived as unnecessarily onerous. The CCE took an active role in assisting with these negotiations and wrote a number of technical reports providing an independent opinion making reference to projects and standards from around the world.

4. Conclusion

For a bridge of this scale a full independent check including independent analysis and verification is essential for ensuring safety. By working within the contractor's organisation, the CCE is able to work in parallel with the design team rather than waiting until completion of the design before commencing work. This allows an interactive checking process whereby analytical results can be compared prior to production of all detailed drawings. The CCE is also able to take a proactive role providing technical advice and helping developing solutions to design problems which inevitably arise during the design process. With the check teams established in different offices to the design team and a controlled approach to the exchange of information, the check has been carried out with independent thinking as well as independent analysis and verification. The CCE is playing a vital role in ensuring the delivery of this complex project safely and on time.

Based on a paper presented by Dr Innes Flett at IABSE symposium, Weimar, 2007(Flett, Carter, Yeoward, Hussain)